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Addition of Algebraic Expressions and Subtraction of Algebraic Expressions (For CBSE, ICSE, IAS, NET, NRA 2022)

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A combination of variables, constants, and operators make an algebraic expression. The four basic operations of mathematics viz. addition, subtraction, multiplication, and division can also be performed on algebraic equations or expressions.

Addition and subtraction of algebraic expressions are almost similar to the addition and subtraction of numbers. But in the case of algebraic expressions, like terms and the unlike terms must be sorted together.

How to Add and Subtract Algebraic Expressions?

The knowledge of like and unlike terms is crucial while studying addition and subtraction of algebraic expressions because the operation of addition and subtraction can only be performed on like terms. The terms whose variables and their exponents are same are known as like terms and the terms having different variables are unlike terms.

Example: $-5x^2 + 12xy - 3y + 7x^2 + xy$

In the given algebraic expression, $-5x^2$ and $7x^2$ are like since both the terms have x^2 as the common variable. Similarly, $12xy$ and xy are like terms.

Addition of Algebraic Expressions

For adding two or more algebraic expression the like terms of both the expressions are grouped together. The coefficients of like terms are added together using simple addition techniques and the variable which is common is retained as it is. The, unlike terms, are retained as it is and the result obtained is the addition of two or more algebraic expressions.

Example:

- Add $5xy - 3x^2 - 12y + 5x$, $xy - 3x - 12yz + 5x^3$ and $y - 6x^2 - zy + 5x^3$

Solution:

Here given three algebraic expression, and these algebraic expressions addition show as given below.

$$5xy - 3x^2 - 12y + 5x$$

$$xy - 3x - 12yz + 5x^3$$

$$y - 6x^2 - zy + 5x^3$$

- Addition:

$$(5xy - 3x^2 - 12y + 5x) + (xy - 3x - 12yz + 5x^3) + (y - 6x^2 - zy + 5x^3)$$

- Here first we sum of the term which have largest degree of x ,

- In three terms, two terms have third degree term, $(5x^3, \&5x^3)$

$$(5xy - 3x^2 - 12y + 5x) + (xy - 3x - 12yz + 5x^3) + (y - 6x^2 - zy + 5x^3)$$

$$10x^3 + 5xy - 3x^2 - 12y + 5x + xy - 3x - 12yz + y - 6x^2 - zy$$

- Then we sum of second degree of terms,

- Second degree terms are $(6x^2, -3x^2)$

$$10x^3 + 5xy - 3x^2 - 12y + 5x + xy - 3x - 12yz + y - 6x^2 - zy$$

$$10x^3 + 5xy - 9x^2 - 12y + 5x + xy - 3x - 12yz + y - zy$$

Then sum of the term of xy ,

$$10x^3 + 5xy - 9x^2 - 12y + 5x + xy - 3x - 12yz + y - zy$$

$$10x^3 - 9x^2 + 6xy - 12y + 5x - 3x - 12yz + y - zy$$

Sum of the term of yz ,

$$10x^3 - 9x^2 + 6xy - 12y + 5x - 3x - 12yz + y - zy$$

$$10x^3 - 9x^2 + 6xy - 13yz - 12y + 5x - 3x + y$$

Sum of term of x ,

$$10x^3 - 9x^2 + 6xy - 13yz - 12y + 5x - 3x + y$$

$$10x^3 - 9x^2 + 6xy - 13yz - 12y + 2x + y$$

Sum of term of y ,

$$10x^3 - 9x^2 + 6xy - 13yz - 12y + 2x + y$$

$$10x^3 - 9x^2 + 6xy - 13yz + 2x - 11y$$

Hence, the answer of $10x^3 - 9x^2 + 6xy - 13yz + 2x - 11y$.

Subtraction of Algebraic Expressions

For subtracting two or more algebraic expressions, it's a better practice to write the expressions to be subtracted below the expression from which it is to be subtracted from. Like terms are placed below each other. The sign of each term which is to be subtracted is reversed and then the resulting expression is added normally.

Example:

Subtract $x^2y - 2x^2 - zy + 5$ and $-3x^2 + 3x^3$ from $y^3 + 3x^2y - 6x^2 - 6zy + 7x^3$

Solution:

The like terms of the expressions $x^2y - 2x^2 - zy + 5$ and $-3x^2 + 3x^3$ are written below the like terms of the expression $y^3 + 3x^2y - 6x^2 - 6zy + 7x^3$.

$$(x^2y - 2x^2 - zy + 5) - (-3x^2 + 3x^3) - (y^3 + 3x^2y - 6x^2 - 6zy + 7x^3)$$

For simplification we unclosethe bracket,

$$x^2y - 2x^2 - zy + 5 + 3x^2 - 3x^3 - y^3 - 3x^2y + 6x^2 + 6zy - 7x^3$$

First the sum of the third degree of x

$$x^2y - 2x^2 - zy + 5 + 3x^2 - 3x^3 - y^3 - 3x^2y + 6x^2 + 6zy - 7x^3$$

$$x^2y - 2x^2 - zy + 5 + 3x^2 - 10x^3 - y^3 - 3x^2y + 6x^2 + 6zy$$

We have third degree of y term is only one.

$$x^2y - 2x^2 - zy + 5 + 3x^2 - 10x^3 - y^3 - 3x^2y + 6x^2 + 6zy$$

Then we sum of the second degree of x term,

$$x^2y - 2x^2 - zy + 5 + 3x^2 - 10x^3 - y^3 - 3x^2y + 6x^2 + 6zy$$

$$10x^3 - y^3 + x^2y + 7x^2 - zy + 5 - 3x^2y + 6zy$$

Now we sum of the x^2y terms,

$$10x^3 - y^3 + x^2y + 7x^2 - zy + 5 - 3x^2y + 6zy$$

$$10x^3 - y^3 + 7x^2 - 2x^2y - zy + 5 + 6zy$$

We sum of the zy terms,

$$10x^3 - y^3 + 7x^2 - 2x^2y - zy + 5 + 6zy$$

$$10x^3 - y^3 + 7x^2 - 2x^2y + 5zy + 5$$

Example:

1. Addition of $5xy - 2x^2 + 3y^3 + 5x^3$ and $3x^3 + zy - 5xy + 5y$ and subtract $3x^2 + 2xy + z$

Solution:

Here given three Algebraic expression,

$$5xy - 2x^2 + 3y^3 + 5x^3$$

$$3x^3 + zy - 5xy + 5y$$

$$3x^2 + 2xy + z$$

$$(5xy - 2x^2 + 3y^3 + 5x^3) + (3x^3 + zy - 5xy + 5y) - (3x^2 + 2xy + z)$$

$$5xy - 2x^2 + 3y^3 + 5x^3 + 3x^3 + zy - 5xy + 5y - 3x^2 - 2xy - z$$

Using same step as above example,

$$8x^3 + 3y^3 - 5x^2 - 2xy + 5y + zy - z$$

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